

2.4.9. Maximum Detection Range

2.4.9.1. Purpose

The purpose of this test is to determine the maximum range at which the radar detects any radar target, the maximum range that can be used for rough navigational orientation, the maximum range that the radar can effectively detect and present a mission relatable target and the effects that these ranges have upon ingress and attack tactics.

2.4.9.2. General

As with air-to-air radars, the air-to-ground maximum range is an important and high interest data point. The air-to-ground maximum range is much more ambiguous than the air-to-air maximum range, and so the exact definition of the maximum range value desired must be provided. For this test, three values will be obtained; first, the maximum range at which any radar returns are received; second, the maximum range at which the radar display is usable for a rough navigational aid and as an aid in positional SA; third, the maximum range at which a mission relatable target can be detected and identified.

The test airplane altitude above the terrain is important for air-to-ground maximum range tests since the maximum displayed range will typically not be beyond the radar horizon. Knowing the test airplane height above the terrain, the radar horizon can be approximately calculated using the following relationship [Ref. 27:p.4-1.3]:

$$R_{\text{horizon}} = 1.23\sqrt{H} \quad (23)$$

R_{horizon} = radar horizon in nm
 H = altitude above the terrain in feet

A test altitude should be chosen that places the radar horizon beyond the maximum display range of the radar to ensure that the maximum ranges displayed are a result of the radar performance and not the geometry of the test. The maximum displayed range data point requires recording the range at which any radar video is displayed. The maximum range for navigation orientation is the maximum range at which the display is coherent enough and of sufficient quality to discern large geographic features such as specific mountain ranges, large peaks, coastlines and bays. The maximum range against mission relatable targets is the range

at which small to medium cultural features (bridges, railways, buildings etc.) can be resolved from the background clutter. It is important to describe the target used for the data point in addition to noting the ranges. It should also be noted that the maximum detection range can sometimes vary greatly from one data point to the next. Usually, a statistically significant set of data points are required. Sample size selection depends mainly upon the variance of the measurements from one test to the next and is discussed in detail in references 43 and 72.

2.4.9.3. Instrumentation

Data cards and an optional voice recorder are required for this test.

2.4.9.4. Data Required

Record the target (if known) and the range for the maximum range displayed video, the maximum range at which targets are displayed that are useful for rough navigation and orientation, and the maximum range at which mission relatable targets are broken out of the clutter. During mission relatable ingresses, note the effects that the maximum radar ranges have upon tactics.

2.4.9.5. Procedure

Before the test flight, analyze a tactical pilotage chart to determine the targets available within the display volume of the radar while in the test area. Try to find a series of targets out to the edge of the display range that satisfy the requirements for rough navigation and for tactically significant targets. A coastline with the associated bays and rivers or a mountain with a series of peaks is useful to find the maximum range for rough navigation. A series of bridges along a river or a series of isolated buildings along a highway can be used as small to medium tactical targets. Choose a test altitude that assures that the maximum display range is unobstructed by the radar horizon using equation 23.

Start the test at one end of the working area, heading towards the other end. Set a 30° to 60° scan angle limit and a range scale that just includes the maximum range at which radar returns are displayed. Mark the maximum range at which radar video is displayed and the target if known. Next, record the maximum range at which features are just usable for rough navigation. Record the

feature that is identified using the radar. Finally, record the range at which tactically significant targets become recognizable along with the identity of the target. Repeat for each radar mode. During mission relatable ingresses, record the effects that the maximum radar ranges have upon ingress and attack tactics.

2.4.9.6. Data Analysis and Presentation

Relate the maximum range at which any radar returns are detected to the absolute maximum range at which a coast line or a large mountain range can be detected. Relate the maximum range at which the radar can be used for rough navigation to the requirement for long range orientation and SA. An example is finding a river outlet for a coast-in point. Relate the maximum range that mission relatable targets become discernable to the requirement to find targets of opportunity far enough away to perform a safe ingress and to optimize the attack on the target. During mission relatable ingresses, use the radar display and a tactical pilotage chart to orient within the target area and attempt to acquire the target at the longest possible range. Assess the utility of the maximum ranges of the radar during these runs.

2.4.9.7. Data Cards

A sample data card is presented as card 32.

CARD NUMBER ____ TIME ____ PRIORITY L/M/H

AIR-TO-GROUND MAXIMUM DETECTION RANGE

[CLIMB TO ____ FEET MSL AND SET ____ KIAS. SELECT A SEARCH MODE WITH A ____° SCAN
 ANGLE LIMIT AND A ____ NM RANGE SCALE. START IN THE ____ CORNER OF THE WORKING AREA
 AND HEAD ____°. REPEAT FOR EACH MODE.]

MODE	MAXIMUM RANGE VIDEO DISPLAYED (TARGET/RANGE)	MAXIMUM RANGE ROUGH NAVIGATION (TARGET/RANGE)	MAXIMUM RANGE MISSION TARGETS (TARGET/RANGE)

[ASSESS THE EFFECTS OF THE MAXIMUM RANGES WHILE NAVIGATING AND DETECTING THE TARGET
 DURING MISSION RELATABLE INGRESSES.]

EFFECTS: